CLAIMS

What is claimed is:

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l	1.	A method of prediction of a process having an associated process metric, the
2	method comprising the steps of:	

- (a) obtaining time-varying measurements of parameters relating to the process;
- 4 (b) decomposing the time-varying measurements into discrete measurement values using an orthogonal transform; and
 - (c) modeling a relationship between the discrete measurement values and the associated process metric to determine a predicted process metric value from an input set of discrete measurement values.
- 1 2. The method of claim 1 wherein the modeling step comprises building a nonlinear
- 2 regression model of the relationship between the discrete measurement values and the
- 3 associated process metric to determine the predicted process metric value.
- 1 3. The method of claim 1 wherein the orthogonal transform is a Fourier transform.
- 1 4. The method of claim 1 wherein the orthogonal transform is a wavelet transform.
- 1 5. The method of claim 1 further comprising the steps of:
- 2 (d) providing at least one range of acceptable discrete measurement values to define a constraint set;
 - (e) identifying a plurality of input process variable values that produce discrete measurement values within the constraint set; and
- (f) using the modeled relationship in conjunction with an optimizer to determine the discrete measurement values, produced by the input process variable values, that produce a predicted process metric value substantially as close as possible to a target process metric value.
- 1 6. The method of claim 5, further comprising the step of repeating steps (a)-(e) for at least one sub-process of the process.
- 1 7. The method of claim 5, further comprising the step of repeating steps (a)-(e) for a
- 2 higher-level process comprising a plurality of the processes.

- 1 8. The method of claim 1 wherein the input set of discrete measurement values is
- 2 obtained by decomposing time-varying measurements into discrete measurement values
- 3 using an orthogonal transform.
- 1 9. An article of manufacture having a computer-readable medium with computer-
- 2 readable instructions embodied thereon for performing the method of claim 1.
- 1 10. A method of prediction and optimization of maintenance actions for a process, the method comprising the steps of:
- 3 (a) obtaining time-varying measurements of parameters relating to the process;
- 4 (b) decomposing the time-varying measurements into discrete measurement 5 values using an orthogonal transform; and
- 6 (c) modeling a relationship between at least one maintenance variable and the 7 discrete measurement values to determine predicted measurement values from an input 8 set of maintenance variable values.
- 1 11. The method of claim 10 wherein the modeling step comprises building a
- 2 nonlinear regression model of the relationship between at least one maintenance variable
- 3 and the discrete measurement values to determine the predicted measurement values.
- 1 12. The method of claim 11 wherein the nonlinear regression model maps a
- 2 relationship between (i) a plurality of maintenance variables and associated process
- 3 inputs, and (ii) discrete measurement values, the nonlinear regression model being used
- 4 to determine a predicted measurement value from an instance of the input set of
- 5 maintenance-variable values.
- 1 13. The method of claim 12 wherein the orthogonal transform is a Fourier transform.
- 1 14. The method of claim 12 wherein the orthogonal transform is a wavelet transform.
- 1 15. The method of claim 12 further comprising the steps of:
- 2 (d) providing at least one range of acceptable values for at least one maintenance variable to define a constraint set; and
- 4 (e) using the modeled relationship in conjunction with an optimizer to determine
- 5 values for the at least one maintenance variable within the constraint set that produce at
- 6 least one predicted discrete measurement value substantially as close as possible to a
- 7 target discrete measurement value.

- 1 16. The method of claim 15, wherein costs are associated with at least one of the
- 2 maintenance values used by the optimizer.
- 1 17. The method of claim 10 further comprising modeling a relationship between (i) an
- 2 input set comprising at least one maintenance variable and the discrete measurement
- 3 values and (ii) the process inputs in order to determine a predicted process metric value
- 4 from an instance of the input set.
- 1 18. An article of manufacture having a computer-readable medium with computer-
- 2 readable instructions embodied thereon for performing the method of claim 10.
- 1 19. A system for predicting a process having an associated process metric,
- 2 comprising:
- 3 (a) a process monitor for monitoring time-varying measurements relating to
- 4 process metrics; and
- 5 (b) a data processing device for predicting the process by (i) decomposing the
- 6 time-varying measurements into discrete measurement values using an orthogonal
- 7 transform, and (ii) modeling a relationship between the discrete measurement values and
- 8 the associated process metric to determine a predicted process metric from an input set of
- 9 discrete measurement values.
- 1 20. The system of claim 19 further comprising a process controller, responsive to the
- 2 data processing device, for adjusting at least one of the processes based on the predicted
- 3 process metric.
- 1 21. The system of claim 19 further comprising a data storage device for providing at
- 2 least one range of acceptable discrete measurement values.
- 1 22. The system of claim 21 further comprising an optimizer for determining values
- 2 for the process inputs that (i) produce predicted discrete measurement values
- 3 substantially as close a possible to a target value provided by the data storage device.
- 1 23. The system of claim 22 wherein the optimizer is a feature of the data processing
- 2 device.
- 1 24. A system for predicting and optimizing maintenance actions for a process,
- 2 comprising:

- (a) a process monitor for monitoring time-varying measurements of parameters
 relating to the process; and
- (b) a data processing device for predicting the process by (i) decomposing the
 time-varying measurements into discrete measurement values using an orthogonal
- 7 transform and (ii) modeling a relationship between at least one maintenance variable and
- 8 the discrete measurement values to determine predicted measurement values from an
- 9 input set of maintenance values.
- 1 25. The system of claim 24 further comprising a process controller, responsive to the
- 2 data processing device, for adjusting at least one of the processes based on the predicted
- 3 process metric.
- 1 26. The system of claim 24 further comprising a data storage device for providing at
- 2 least one range of acceptable discrete measurement values.
- 1 27. The system of claim 26 further comprising an optimizer for determining
- 2 measurement values that (i) produce a predicted process metric value substantially as
- 3 close a possible to a target process metric, and (ii) are within the at least one range of
- 4 acceptable values for the discrete measurement values provided by the data storage
- 5 device.